

REMARKS

Claims 1, 2, 7-9, 11, 13, 14, 16-18 and 26-29 remain in this application. Claims 1, 2, 7-9, 11, 13, 14, 16-18, 26 and 27 stand rejected. Claims 28 and 29 are newly presented. Claims 3-6, 10, 12, 15, 19-25 have been cancelled.

The title has been amended in response to the cancellation of claims subject to a restriction requirement. New matter has not been added to the title.

Claims 1, 7-9, 11, 13, 16-18, 26 and 27 have been amended. The amendments are made to incorporate limitations of dependent claims into independent claims, and no new matter has been added.

FIG. 5 has been amended to show a third alignment pad, and the specification has been amended to incorporate the reference number for same. These amendments do not add new matter.

Attached hereto is a marked-up version of the changes made to the title, specification and claims by the current amendment. The attachment is captioned **VERSION WITH MARKINGS TO SHOW CHANGES MADE.**

1. Objection to Drawings

The drawings stand objected to under 37 CFR 1.83(a) in that they do not show the claimed "three alignment pads". A drawing proposal adding same is therefore submitted herewith. The drawing proposal is not believed to introduce new matter in that it adds "a third alignment pad" at a corner of the integrated circuit package shown in FIG. 5, and applicants' originally disclosed that:

The alignment mechanism comprises a number of alignment pads 500, 502 (at least two, and preferably three) which are applied to a package 100 at known locations (e.g., at corners) with respect to the package's pattern of contact pads 106, 108.

Page 10, lines 8-11.

FIGS. 7 & 8 already show how either alignment balls or alignment bullets can

be attached to the alignment pads shown in FIG. 5.

2. Objection to Claim 17

Claim 17 stands objected to in that "alignment members" should read -- alignment bullets-- and "said wetting media" should read --a wetting media--. Both changes have been made.

3. Rejection of Claims 13, 16-18 and 27 Under 35 U.S.C. 102(e)

Claims 13, 16-18 and 27 stand rejected under 35 U.S.C. 102(e) as being anticipated by Coico et al. (U.S. Pat. No. 6,354,844; hereinafter referred to as "Coico").

In light of applicants' amendments to claims 13, 16-18 and 27, the Examiner's rejection over Coico is now moot. Claims 13, 16-18 and 27 now comprise limitations reciting "annular ring shaped alignment pads". The Examiner has admitted that Coico does not teach these.

Claims 13, 16-18 and 27 are therefore believed to be allowable over the teachings of Coico.

4. Rejection of Claims 1, 2, 7-9, 11 and 26 Under 35 U.S.C. 103(a)

Claims 1, 2, 7-9, 11 and 26 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Coico et al. (U.S. Pat. No. 6,354,844; hereinafter referred to as "Coico") in view of Rostoker et al. (U.S. Pat. No. 5,558,271; hereinafter referred to as "Rostoker").

With respect to claim 1, the Examiner admits that Coico does not teach annular ring shaped alignment pads. However, the Examiner asserts that:

Rostoker et al. while related to a similar apparatus for aligning a ball/bump on a bond pad teach (see specifically figures 3a-3b, 4a-4b, and 6a-6b) the pad 410/310, which has a diameter smaller than that of the mating conductive ball 640 (e.g., alignment member), is formed with a centrally located opening 415/315 for the purpose of mechanically registering a mating conductive ball/bump contact (Col. 8, lines 37+) via the solder paste (e.g., wetting media) 420/320 (Col. 8, lines 5+, Co. 7, lines 26+) and improving the joining technique for formation of joints in solder ball joining processes (Col. 4, lines 1+ and lines 12+).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the device structure of Coico et al. by applying the annular ring shaped bond pad of Rostoker et al. in order to improve the joining technique for formation of joints in solder ball joining processes.

12/13/2002 Office Action, sec. 8, pp. 4-5.

Applicants respectfully disagree with the Examiner's above characterization of, and reliance on, Rostoker.

Rostoker teaches how to mechanically align two substrates, one of which comprises a conductive bump contact 640a with a convex surface 645a, and one of which comprises a conductive bump contact 620a with a concave surface (or void 630a). The contact 640a with the convex surface 645a is received by the contact 620a with the void 630a. See Rostoker, col. 9, lines 18-28. Rostoker further teaches that the contact 620a with the void 630a may be formed by re-flowing solder paste (320a-c or 410a-b) that is applied to a ring-shaped bond pad (310 or 410). If a lesser amount of solder paste is applied to the ring-shaped bond pad, the solder re-flow process will result in the solder paste pulling away from the pad's void, thus forming a ring-shaped contact. See Rostoker, col. 7, line 1 - col. 8, line 40. With respect to formation of the contact 640a with a convex surface 645a, Rostoker never discloses (or even suggests) that such a contact could be formed on a ring-shaped bond pad. In FIG. 2, Rostoker shows bond pads (210a and 210b) for a convex contact, but never indicates they could be ring-shaped. In FIGS. 6a & 6b, Rostoker does not show the bond pads on which convex contacts 640a and 640b are formed. In FIG. 7, Rostoker shows a convex contact 750 formed directly on a substrate 760. In FIG. 9, Rostoker shows a pin-shaped contact 920b coupled to a bond pad 910b, but again provides no indication that bond pad 910b should or could be ring-shaped.

In contrast to what is taught by Rostoker (that is, the mating of 1) a first substrate having a concave contact formed on a ring-shaped bond pad, to 2) a second substrate having a convex contact formed on a conventional, flat bond pad), applicants' amended claim 1 is directed to a single integrated circuit package on which a number of annular ring shaped alignment pads are applied, and to which a number of alignment balls are attached. Rostoker does not teach a single device on which an annular ring shaped alignment pad is applied, and to which an alignment ball is attached. Nor does Rostoker make any suggestion that this be done. Rostoker only teaches the mating of a ring-shaped contact and a concave contact that are formed on two different substrates.

Given that the combined teachings of Coico and Rostoker do not teach an alignment ball attached to an annular ring shaped alignment pad, applicants' claim 1, as amended, is believed to be allowable over the combined teachings of Coico and Rostoker.

Claims 2, 7-9 and 11, as amended, are believed to be allowable over the combined teachings of Coico and Rostoker at least for the reason that they depend from an allowable claim 1. Further, with respect to claim 8, applicants cannot ascertain where Rostoker teaches a diameter of a ring-shaped bond pad that is smaller than that of a conductive ball which is mated to it. In FIGS. 6a & 6b, convex contacts 640a and 640b are not shown to be balls and, as pictured, their diameters are not greater than those of the concave bond pads 620a and 620b to which they are mated.

Claim 26, as amended, is believed to be allowable over the combined teachings of Coico and Rostoker for the same reason that claim 1 is believed to be allowable over their combined teachings.

5. Rejection of Claims 1, 2, and 26 Under 35 U.S.C. 103(a)

Claims 1, 2 and 26 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Coico et al. (U.S. Pat. No. 6,354,844; hereinafter referred to as "Coico") in view of Sawaya (U.S. Pat. No. 5,191,511).

With respect to claim 1, the Examiner admits that Coico does not teach annular ring shaped alignment pads. However, the Examiner asserts that:

Sawaya while related to a similar semiconductor package design teaches (see specifically figures 2-3) the pad 9, which is applied to a surface of the integrated circuit package 1, is in annular ring shaped (Col. 3, lines 47+), and the bullet (bump) 8 having an end comprising a raised disc to protrude into the ring shaped pad 9. The purpose of doing so would improve the bonding contact of the bullet (bump) 8 to the ring pad 9 and to the integrated circuit package 1.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Coico et al.'s device by applying the annular ring shaped bond pad of Sawaya in order to improve the bonding contact of the alignment bullet (bump) to the ring alignment pad and to the integrated circuit package, and such modification is held to be within the ordinary designing ability expected of a person skilled in the art.

12/13/2002 Office Action, sec. 9, pp. 6-7.

Applicants respectfully disagree with the Examiner's above characterization of, and reliance on, Sawaya.

Sawaya teaches how to replace the terminals of a package body 1 with a pattern of conductive bumps 8. Nowhere does Sawaya indicate that the bumps 8 are "alignment members" (e.g., alignment balls or alignment bullets). Rather, Sawaya merely indicates that the bumps 8 are "terminals". See Sawaya, col. 3, lines 39-45. Furthermore, Sawaya does not explain how a package body 1 with bumps 8 would be aligned with another device or substrate, and only states that, "the package of this invention is suitable for mounting on the printed circuit board by the surface mounting method" (col. 4, lines 54-56). Also, Sawaya does not disclose the attachment of alignment bullets to ring-shaped alignment pads, but rather discloses the printing of pasted solder alloys on a land pattern 9 to create bumps 8. The printing of pasted solder alloys is not equivalent to attaching alignment bullets.

Claim 1, as amended, is believed to be allowable over the combined teachings of Coico and Sawaya for the above reasons.

Claim 2 is believed to be allowable over the combined teachings of Coico and Sawaya at least for the reason that it depends from an allowable claim 1.

Claim 26, as amended, is believed to be allowable over the combined

teachings of Coico and Sawaya for the same reason that claim 1 is believed to be allowable over their combined teachings

6. Allowable Claim

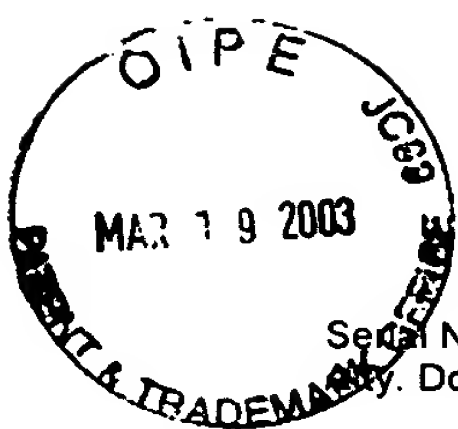
Claim 18 is similar to originally filed claim 12, and is therefore believed to be allowable for at least the reasons the Examiner believed originally filed claim 12 to be allowable.

CONCLUSION

Applicants request that a timely Notice of Allowance be issued in this case.

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-1-

VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the Title:

The title has been amended as follows:

[METHODS AND] APPARATUS FOR ALIGNING AN INTEGRATED CIRCUIT PACKAGE WITH AN INTERFACE

In the Specification:

The paragraph beginning at page 10, line 3, has been amended as follows:

Currently, the pitch of contact pads 106, 108 on a CLGA package 100 is such that the spring clips 302-308 of the FIG. 3 socket 300 provide a means for grossly aligning a package's contact pads 106, 108 over a socket's elastomer buttons 402, 404. A mechanism for fine-tuning a package's alignment is therefore needed. Such an alignment mechanism is illustrated in FIG. 5. The alignment mechanism comprises a number of alignment pads 500, 502, 504 (at least two, and preferably three) which are applied to a package 100 at known locations (e.g., at corners) with respect to the package's pattern of contact pads 106, 108. Preferably, the alignment pads 500, 502, 504 are applied to the same surface as the pattern of contact pads 106, 108. The alignment pads 500, 502, 504 are also preferably applied to the package 100 at the same time that the pattern of contact pads 106, 108 is applied to the package 100. In this manner, their locations with respect to the package's contact pads 106, 108 can be more precisely controlled. For example, the alignment pads 500, 502, 504 may be applied at the same time that the contact pads 106, 108 are applied, by means of a silk screening, stenciling, or plating operation.

The paragraph beginning on page 10, line 20, has been amended as follows:

Each of the FIG. 5 alignment pads 500, 502, 504 may be used as a means for attaching (e.g., soldering) an alignment member to an integrated circuit package, as illustrated in FIGS. 7, 8, 11 & 14. A more detailed discussion of the means by which an alignment member may be attached to an alignment pad is found below. However, this discussion is preceded by a discussion of the types of alignment members which may be attached to an alignment pad.

In the Claims:

Claims 3-6, 10, 12, 15, 19-25 have been canceled.

Claims 1, 7-9, 11, 13, 16-18, 26 and 27 have been amended as follows:

1. (Amended) An integrated circuit package, comprising:

- a) a pattern of contact pads applied to a surface of the integrated circuit package; [and]
- b) a number of annular ring shaped alignment pads applied to said surface at known locations with respect to said pattern of contact pads; and
- c) a number of alignment balls attached to said number of annular ring shaped alignment pads.

7. (Amended) An integrated circuit package as in claim [3]1, wherein at least one of said number of alignment [members]balls is hard enough to resist deformation as said integrated circuit package is aligned with an interface.

8. (Amended) An integrated circuit package as in claim [3]1, wherein diameters of said number of annular ring shaped alignment pads are smaller than diameters of said number of alignment [members]balls.

9. (Amended) An integrated circuit package as in claim 1, further comprising a wetting media [deposited to]that attaches said number of alignment balls to said number of annular ring shaped alignment pads.

11. (Amended) An integrated circuit package as in claim 1, wherein said pattern of contact pads forms a land grid array, [and] wherein said number of annular ring shaped alignment pads is three, and wherein said alignment balls are hard enough to resist deformation as said integrated circuit package is aligned with an interface; said integrated circuit package further comprising[:

- a)] a wetting media [deposited to]that attaches said number of alignment balls to said number of annular ring shaped alignment pads[: and
- b) an alignment ball attached to each of said annular ring shaped alignment pads via said wetting media, wherein said alignment balls are hard enough to resist deformation as said integrated circuit package is aligned with an interface].

13. (Amended) An integrated circuit package, comprising:

- a) a pattern of contact pads applied to a surface of the integrated circuit package; [and]
- b) a number of annular ring shaped alignment pads applied to said surface at known locations with respect to said pattern of contact pads; and
- c) a number of alignment bullets attached to said [surface at known locations with respect to said pattern of contact pads]number of annular ring shaped alignment pads.

16. (Amended) An integrated circuit package as in claim [15]13, wherein said number of alignment pads is three.

17. (Amended) An integrated circuit package as in claim [15]13, [wherein]further comprising a wetting media that attaches said number of alignment [members is attached]bullets to said number of annular ring shaped alignment pads [via said

wetting media].

18. (Amended) An integrated circuit package as in claim 13, wherein said pattern of contact pads forms a land grid array, wherein said number of alignment bullets is three, and wherein said alignment bullets are hard enough to resist deformation as said integrated circuit package is aligned with an interface[,]; said integrated circuit package further comprising[:

- a) three alignment pads applied to said surface at known locations with respect to said pattern of contact pads; and
- b)] a wetting media [deposited to]that attaches said number of alignment bullets to said number of annular ring shaped alignment pads[, said alignment bullets being attached to said alignment pads via said wetting media].

26. (Amended) An integrated circuit package, comprising:

- a) electrical contact means applied to a surface of the integrated circuit package; [and]
- b) a number of annular ring shaped alignment means applied to said surface at known locations with respect to said electrical contact means; and
- c) a number of alignment balls attached to said number of annular ring shaped alignment pads.

27. (Amended) An integrated circuit package, comprising:

- a) electrical contact means applied to a surface of the integrated circuit package; [and]
- b) a number of annular ring shaped alignment means applied to said surface at known locations with respect to said electrical contact means; and
- c) a number of bullet shaped alignment means attached to said [surface at known locations with respect to said electrical contact means]number of annular ring shaped alignment pads.

The following new claims have been presented:

28. (New) An integrated circuit package as in claim 13, wherein at least one of said number of alignment bullets has an end which is shaped to protrude into one of said number of annular ring shaped alignment pads.

29. (New) An integrated circuit package as in claim 28, wherein said end of said at least one alignment bullet comprises a raised disc.